

**PURCHASE and INSTALLATION OF GABLE BRACING FOR VARIOUS INTACT
MITIGATION HOMES**

DUE DATE: May 2, 2008

**St. Lucie Inspired Network to Achieve Community Together (INTACT)
437 N 7th Street, Fort Pierce, FL 34950
772-462-1777**

CALL FOR BIDS

Bids will be received at Community Services on behalf of St. Lucie INTACT, 437 N 7th Street, Fort Pierce, FL 34950, by May 2, 2008 for the following:

PURCHASE and INSTALLATION OF GABLE BRACING FOR VARIOUS INTACT MITIGATION HOMES

St. Lucie INTACT, long-term recovery organization, invites licensed contractors to submit bids to install gable end bracing and roof to wall strapping for low-income families in St. Lucie County. Prices should be itemized and all encompassing.

Bid documents may be obtained via the internet at www.stlucieco.gov/community/intact.htm. If you do not have internet access, you may obtain the documents by calling the INTACT office at 772-462-1777.

Bids may be either mailed or hand delivered to INTACT care of St. Lucie County Community Services Department. Any applying contractor needs to be willing to track all costs by site, including hours, materials, permit costs, and labor. Products must meet or exceed wind-borne debris impacts and wind loads tests of **Miami-Dade Building Code** standard. Bracing must be completed with strict adherence to the My Safe Florida Home guidelines (see attached). Bids will be opened at 437 N 7th Street on May 5 at 1 pm.

SEALED BIDS: All bid sheets and this form must be executed and submitted in a sealed envelope. The face of the envelope shall contain, in addition to the above address, the date and time of the bid opening. Bids not submitted on attached bid form shall be rejected. All bids are subject to the conditions specified herein. Those which do not comply with these conditions are subject to rejection.

St. Lucie INTACT reserves the right to waive any informalities or minor irregularities; reject any and all bids/proposals which are incomplete, conditional, obscure, or which contain additions not allowed for; accept or reject any proposal in whole or in part with or without cause; and accept the proposals which best serves INTACT and community residents.

PUBLISH: April 20, 2008.

Before sending in your bid, please make sure you have completed all of the following:

- ☐ Enclose three (3) COMPLETE sets of the Bid package (one marked original and two marked copy). Include all handwritten sections, plus three (3) sets of any descriptive literature, brochures and/or supporting data. Please make and retain a separate copy of this bid package for your records.
- ☐ Bid Form must be complete and have a manual signature (original) preferably signed in blue ink.
- ☐ Include proof of proper licensing and bonding as stated in bid documents.
- ☐ Provide three (3) references for your prior work. Include name, address and phone number for similar work done in past year.
- ☐ Erasures or other descriptive literature, brochures and/or data must be initialed by the person signing the bid.
- ☐ All engineering and/or NOA must be submitted with application.

PLEASE INITIAL AND RETURN WITH BID FORM

- To be considered to do retrofit improvements allowed under the program, contractors must complete or already have completed a four-hour course on residential wind-resistance retrofit improvements.

The natural person holding the contractor's license is the one who must take or have taken the **FLASH Blueprint for Safety** course since 1-1-04. It is not sufficient that one of the contractor's employees or a co-worker of the contractor has taken or will take the course. For a construction business that has a single primary qualifying contractor licensee, that primary qualifying licensee is the one who must take or have taken the course since 1-1-04. For an entity that has multiple primary qualifying agent contractor licensees, it is sufficient for any one of those primary qualifying licensees to take or have taken the course since 1-1-04.

<http://www.mysafefloridahome.com/forretrofitpros.asp>

<http://www.flash.org/registration/registration.cfm>

- This is a general bid request with the potential to serve up to 50 homes by the end of December 2008. Each home will be made accessible for contractor measurements/access as needed once contracts have been signed. Permitting costs may be broken out and included in the bid, with the knowledge that cost may vary based on municipality.
- St. Lucie INTACT reserves the right to allow for the clarification of questionable entries and for the correction of typographical and mathematical errors.
- The obligations of St. Lucie INTACT under this award are subject to the availability of funds lawfully appropriated for the purpose by Volunteer Florida Foundation and St. Lucie INTACT.
- All discounts and extra services EXCEPT THOSE FOR PROMPT PAYMENT shall be considered in determining the lowest net cost for bid evaluation purposes. It is recommended that such discounts be indicated in your bid.
- Any manufacturer's names, trade names, brand names, information and/or catalog numbers listed in a specification are for information only and not to limit competition. Bid any brand, which meets or exceeds the quality of specifications listed for any item. If the bid is based on equivalent products, indicate on the bid form the manufacturer's name and number and indicate any deviation from the specifications as listed. Include fully descriptive literature on item(s). Lacking any written indication of intent to quote an equivalent brand or model number, the bid will be considered as a quotation in complete compliance with the specifications as listed in the bid form.
- **Show number of days required to complete work.** Delivery time may become a basis for making an award. Delivery shall be within the normal working hours of the user.
- The bidder shall indemnify and hold harmless St. Lucie INTACT, its officers, agents, and employees against any claims by third parties arising out of the acts or omissions of the supplier.
- The bidder, without exception, shall indemnify and save harmless St. Lucie INTACT, its officers, agents, and its employees from liability of any nature of kind, including cost and expenses for or on account of any copyrighted, patented, or unpatented invention, process, or article manufactured or used in the performance of the contract, including its use by the INTACT. If the bidder uses any design, device, or materials covered by letters, patent, copyright, it is mutually agreed and understood without exception that the bid price shall include all royalties or cost arising from the use of such design, device, or materials in any involved in the work.
- Unless otherwise specified, bidder(s) may be required at the convenience of the INTACT, to provide training to INTACT representatives in the operation and maintenance of any item(s) purchased from this bid.
- Items may be tested for compliance with specifications. Items delivered not conforming to specifications may be rejected and returned at vendor's expense. Those items and items not delivered as per delivery date in bid and/or purchase order may be purchased on the open market. Any increase in cost may be charged against the vendor. Any violations of these stipulations may also result in that vendor name being removed from the bidder list and the vendor disqualified for doing business with St. Lucie INTACT.
- The selling dealer, distributor, supplier, and manufacturer shall be responsible for having complied with all Federal, State and local standards, regulations, and laws concerning the equipment specified and the use thereof, applicable and effective on the date of manufacture including safety and environmental standards as apply to both private industry and governmental agencies.
- The bidder agrees that, unless otherwise specified, the supplies and/or services furnished under this bid shall be covered by the most favorable commercial warranty the bidder gives to any customer for comparable quantities of such supplies and/or services and that the rights and remedies

provided herein are in addition to and do not limit any rights afforded to the INTACT by any other provision of this bid.

- Inspection and acceptance will be at destination unless otherwise provided. Title to/or risk of loss or damage to all items shall be the responsibility of the successful bidder until acceptance by the buyer unless loss or damage results from negligence by the buyer.
- Payment will be made by INTACT after the items awarded to a vendor have been received and/or installed, inspected, and found to comply with award specifications, free of damage or defect and properly invoiced.
- In case of any doubt or difference of opinion as to the items furnished hereunder, the decision of INTACT shall be final and binding on both parties.
- Federal, State, County, and local laws, ordinances, rules and regulations that in any manner affect the items covered herein apply. Lack of knowledge by the bidder will in no way be a cause for relief from responsibility.
- No guarantee is expressed or implied as to the total quantity of commodities/services to be purchased under any open-end contract. Estimated quantities will be used for bid comparison purposes only.
- The award hereunder is subject to provisions of State. All bidders must disclose with their bid the name of any officer, director, member or applicant who is also connected with St. Lucie INTACT. Further, all bidders must disclose the name of any INTACT member or officer who owns directly or indirectly any interest in the bidder's firm or any of its branches.
- No delivery shall become due or be acceptable without a written order or shipping instruction by INTACT unless otherwise provided in the Contract. Such order will contain the quantity, time of delivery and other pertinent data. However, on items urgently required the Seller may be given telephone notice to be confirmed by an order in writing.
- All changes shall be by issuance of a change order. Any modifications or changes to any contract entered into as a result of this bid must be by written amendment with the same formality and of equal dignity to the initiation of any such change.
- No person shall engage in or manage any business, profession, or occupation in St. Lucie County for which an occupation license tax is required unless a County License shall have been procured from the Tax Collector for St. Lucie County. State Certified Contractors not maintaining a place of business within St. Lucie County, but wishing to engage in the business of contracting in the unincorporated areas of St. Lucie County, shall be required to register their State Certification with the St. Lucie County Contractor Licensing Division, 2300 Virginia Avenue, Fort Pierce, Florida 34982. St. Lucie does not issue "competency cards" to State Certified Contractors, but upon registration, there is a certification number assigned. Possession of proper licensing/registration must be attained prior to bid submittal and included with bid proposal.
- INTACT reserves the right to amend this bid or request additional clarifying information from any or all bidders prior to determination of award. Any changes to this bid will be made available for all prospective bidders to receive. Although we will attempt to notify you of all addenda, it is the sole responsibility of the bidder to ensure it is received.
- This bid may be expanded to include other agencies. Each entity will be responsible for execution of its own requirements with the awarded vendor. The successful bidder will enter into a written contract with INTACT and the individual homeowner in accordance with the accepted bid. St. Lucie INTACT reserves the right to award all or part of this bid or select multiple bidders, if in the best interest of INTACT and county residents.
- INTACT will not intentionally award publicly-funded contracts to any contractor who knowingly employs unauthorized alien workers, constituting a violation of the employment provisions contained in 8 U.S.C. Section 1324a(e) [Section 274A(e) of the Immigration and Nationality Act ("INA")]. INTACT shall consider the employment by any contractor of unauthorized aliens a violation of Section 274A(e) of the INA. Such violation by the Recipient of the employment provisions contained in Section 274A(e) of the INA shall be grounds for unilateral cancellation of this Agreement with INTACT.
- Bonds must be issued by a Bonding Company with a Best Insurance Guide's rating of "A" or better and must be licensed or authorized to do business in the State of Florida. Certificates of insurance,

Public Construction Bonds and/or Maintenance Bonds must be received by INTACT office prior to actual commencement of the project. All certificates of insurance shall list INTACT as Additional Insured and reference the specific project.

BONDS

- A. Yes _____ No ☒ **5% Bid Security**
B. Yes _____ No ☒ **100% Maintenance Bond** _____ years
C. Yes _____ No ☒ **100% Public Construction Bond**

INSURANCE

- A. Yes ☒ No _____ **Worker's Compensation**
\$500,000 by accident - each accident
\$500,000 by disease - each employee
\$500,000 by disease - policy limit
B. Yes ☒ No _____ **Commercial General Liability**
\$1,000,000 per occurrence
\$2,000,000 per job aggregate
C. Yes ☒ No _____ **Commercial Auto Liability**
Combined Single Limit, Bodily Injury/Property Damage
_____ \$300,000 ☒ \$1,000,000 _____ \$3,000,000
D. Yes No ☒ **Builder's Risk** (all risks for the total construction cost of the project)
E. Yes No ☒ **Professional Liability** \$1,000,000 aggregate
F. Yes No ☒ **Other** _____

- INTACT reserves the right to reject any or all bids, to waive informalities, and to accept all or any part of any bid as may be deemed to be in the best interest of INTACT and applicants. Bids will be evaluated on price, delivery times, experience and longevity in the community, capability, reliability, and integrity of vendor. Selections will be based on the proposal(s) that are determined to be most advantageous to INTACT and low income homeowners.

Scope of Work

Securing the Roof - Gable End Bracing & Roof to Wall Strapping

All gable end walls must be tied back to the roof or ceiling structure with bracing designed using rational analysis based on wind loads calculated according to ASCE 7-98 using a Basic Wind Speed defined by ASCE 7-98 but not less than 140 mph.

Bracing needs to be installed along the top and the bottom of the gable end. In addition, the gable end should be connected to the top of the end wall using metal hurricane connectors. Bracing at the top of the gable end can be done in two ways: One method is to install 8' long 2x4 members at 6' o/c perpendicular to the gable end surface on the underside of the top chord of the trusses. Another method is to install 2x4 blocking at 48" o/c. between the gable end framing and first two interior rafters or truss top chords.

One of the weakest points is located where the gable wall bottom meets the top of the wall. A hinge located at this point allows the gable end wall to pull out. This joint must be strengthened to resist not just the lateral loads, but also the uplift and longitudinal loads. Mid-height brace is required for tall gable end walls in addition to bottom cord bracing.

Blueprint for Safety recommends installing bracing at the bottom of the gable end. Secure the gable end wall by using 2x4 members with a minimum length of 8' installed perpendicular to the plane of the gable end at 6' o/c. as shown in Figure 3.3. These bracing members should be connected to the bottom chord of the gable end truss or to the base of the studs of a framed gable end with metal connectors and fastened to each of the interior framing members they intersect – either the bottom chords of the interior trusses or other framing members. These connections should be made with a minimum of two 16d nails at each intersection. Appendix details 22 and 23 also illustrate methods to meet the gable end wall forces.

See attachments from Blue Print for Safety for additional information and requirements.
<http://www.esteeming.org/mysafefloridahome/index.php>

Permits must be pulled and final inspections completed where needed.

BID FORM

All bids must be submitted in an envelope addressed to St. Lucie INTACT c/o Community Services, 437 N 7th Street, Fort Pierce, FL 34950, by May 2, 2008 for the following:

**PURCHASE and/or INSTALLATION GABLE END BRACING AND ROOF TO WALL STRAPPING FOR
VARIOUS INTACT MITIGATION HOMES**

I, _____ REPRESENTING

Company and/or Corporation, agree to perform all of the requirements to complete the work required in the specifications for the price of: Base Bids: (Bid price to include: all materials, labor, installation, finish work).

Bid Obligation

It is understood that this Bidder is bound by the bidding documents and that the bid may not be withdrawn during a period of 60 days after bid opening. INTACT reserves the right to waive any informalities or minor irregularities, reject any and all bids which are incomplete, conditional, obscure, or which contain additions not allowed for, accept or reject any bid in whole or in part with or without cause, and accept the bid which best serves INTACT and county residents.

NAME OF BIDDER _____

ADDRESS: _____

CITY, STATE, ZIP: _____

PHONE: _____

EMAIL: _____ @ _____

SIGNED BY: _____

TITLE: _____ DATE: _____

SEALED BIDS: All bid sheets and this form must be executed and submitted in a sealed envelope. The face of the envelope shall contain, in addition to the above address, the date and time of the bid opening and the bid number. Bids not submitted on attached bid form shall be rejected. All bids are subject to the conditions specified herein. Those which do not comply with these conditions are subject to rejection

My Safe Florida Home



Courses provided by: Construction Estimating Institute

Section 1: Introduction to Gable Ends

After unreinforced garage doors and unprotected sliding glass patio doors, gable ends are probably the most likely part of the building envelope to fail during a hurricane. In fact, insurance companies give policy premium discounts to homes that have no gable ends in the roof design. Since the active hurricane seasons of 2004 and 2005, many building industry representatives, including lumber and component manufacturers, building science consultants, homebuilders, even do-it-yourself homeowners, have been searching for cost-effective methods to strengthen gable ends. The FL Department of Community Affairs, through its Division of Emergency Management, Bureau of Mitigation, has compiled a list of recommended steps to reinforce gable ends as part of its extensive Hurricane Retrofit Guide series. To view the entire Hurricane Retrofit Guide series of recommendations for improvements that make homes more hurricane-resistant, write down the following web site and visit it after you complete this course:

www.floridadisaster.org/Mitigation/rcmp/HRG/index.asp.

Gable ends often fail at the top where they connect to the roof sheathing. Less frequently, gable ends fail at the bottom where they connect to the supporting wall below. In the worst case, the sheathing is sucked completely off the wall, the fasteners holding the gable end studs in place can fail, or the studs themselves can fail under the battering of the tropical storm winds. This results in the destruction of this entire triangular portion of the wall, allowing wind and rain into the space below the roof sheathing placing the entire structure at risk.

The first picture shows the most common type of gable end failure in which the fasteners attaching the sheathing to the top of the gable end truss have failed and the top of the truss has been sucked out of the opening.



source: FL Division of Emergency Management

The second picture shows a failure at the joint between the bottom of the gable end truss and the supporting wall. Surprisingly in this instance, the top joint held.

Gable ends are like sails and, during storms, they are subjected to positive pressures when the wind is blowing directly against them and negative or “suction” pressures when the wind is blowing from the opposite side of the house or from an angle. The taller the gable end, the more wind force it will experience.

There are 2 basic types of roof assemblies:



source: FL Division of Emergency Management

- Site-built (“stick-built”) composed of ridge, rafters, ceiling joists, etc., or
- Trusses.

The basic approach for both types of roof assemblies is to reinforce the gable ends at 3 points:

- By strengthening the connection at the top of the wall
- By strengthening the connection at the bottom of the wall
- And by reinforcing the sheathing and the studs that make up the wall itself.

All of the techniques for gable end reinforcement described in this course will be much easier to accomplish if the roof covering is ready to be replaced. During the process of re-roofing, sheathing above the gable ends can be removed revealing the underlying roof structure. The recommended framing improvements can be made and new sheathing can be installed with adhesive and nailed to current code specifications.

If the roof is not being replaced, the following techniques have to be carried out in the access area above the ceiling and below the roof sheathing. This can be extremely problematic. Getting to the work area from existing access points alone can be a challenge, and any work has to be carried out without damaging the finished ceiling below. Often there are obstructions to work around such as electrical wires, water lines, HVAC ducts, and recessed light fixtures to name just a few. Furthermore, any attic space with less than 3 feet of headroom is, for all practical purposes, inaccessible. Fortunately, the wind forces acting on gable ends are not a major concern until the height of the gable end at the peak is greater than 4 feet. Vaulted and cathedral ceilings present problems of their own which are discussed at the end of this course.

To continue with Module 4, please click [Section 2](#).

Section 2: Bracing the Top of the Gable End Wall

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Construction Estimating Institute
5016 Calle Minorga Road
Sarasota, FL 34242
1.800.423.7058

Click [here](#) to go to the Home page.

My Safe Florida Home



Courses provided by: Construction Estimating Institute

Section 2: Bracing the Top of the Gable End Wall

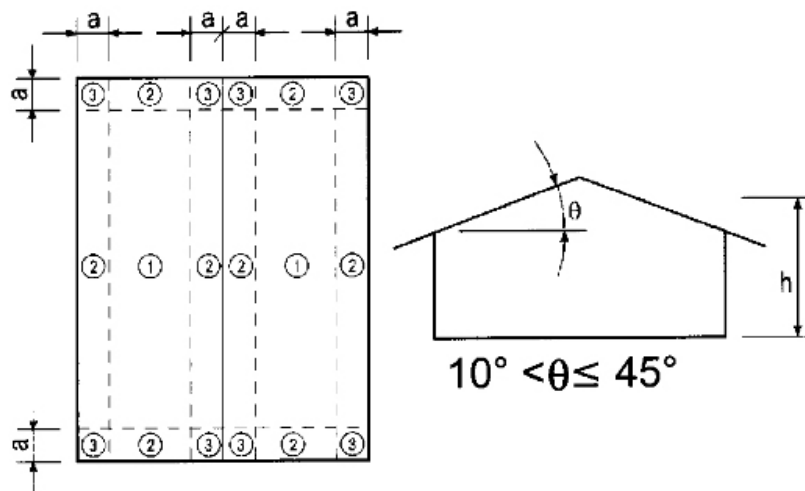
Strengthening the connection at the top of the wall revolves around 2 main steps:

1. Reinforcing the attachment of the sheathing to the top of the trusses or rafters.
2. Attaching a series of horizontal braces to the underside of the top truss chords (or rafters if the roof is stick-built) and attaching the end of these braces to the gable end retrofit studs.

Reinforcing the Attachment of the Roof Sheathing

If the roof covering is being replaced, the sheathing at the gable end can easily be re-nailed to current standards for Wind-borne Debris Regions. According to the 2004 FL Building Code, roof sheathing for roofs in Basic Wind Speed zones 110 to 140 mph should be nailed as follows:

- 8d common nails for panels from 15/32" to 19/32"
- Nails should be spaced 6" on center at panel edges and intermediate supports
- Nails should be spaced 4" on center at panel edges and intermediate supports at locations marked #3 (the corners and the peaks of the gable ends) in the following diagram.



GABLE ROOFS

$10^\circ < \theta \leq 45^\circ$

source: 2004 Florida Building Code

(Note: roof angles of 10 degrees are approximately equivalent to slopes of 2 in 12. Roof angles of 45 degrees are equal to slopes of 12 in 12. For roof sheathing nailing requirements on roofs with slopes lower than 10 degrees or steeper than 45 degrees, consult the 2004 Florida Building Code.)

To meet building code requirements, nails for pneumatic guns should be full-head, not clipped-head type and the shank diameter must be equivalent to that of an 8d common nail (0.131").

Joints between sheathing panel edges within 6' of the gable end should be supported by 2x4 or 2x6 blocking beneath. If the sheathing has been removed in the re-roofing process, the blocking can be installed as part of the gable end bracing improvements. Otherwise the blocking must be installed from below (after clipping off the ends of any shingle nails on either side of the joint being supported). These blocks should be installed with sub-floor type construction adhesive between the block and the sheathing and fastened to the adjacent truss chords or rafters with 10d nails minimum.



source: FL Division of Emergency Management

New sheathing within 6' of gable ends should be installed with a 1/4" bead of adhesive on each truss chord or rafter. If existing sheathing is not being removed, a 1/4" bead of sub-floor adhesive should be applied to each side of each truss chord or rafter supporting the panels.



source: FL Division of Emergency Management

At the gable end truss, apply a 1/4" bead of construction adhesive to the side of the top chord and another 1/4" bead to the underside of the sheathing. Nail a 2x2 strip to the side of the gable end truss chord that sandwiches this adhesive to the sheathing and the truss (see picture below).

Installing Horizontal Braces Below the Top Chords or Rafters



source: FL Division of Emergency Management

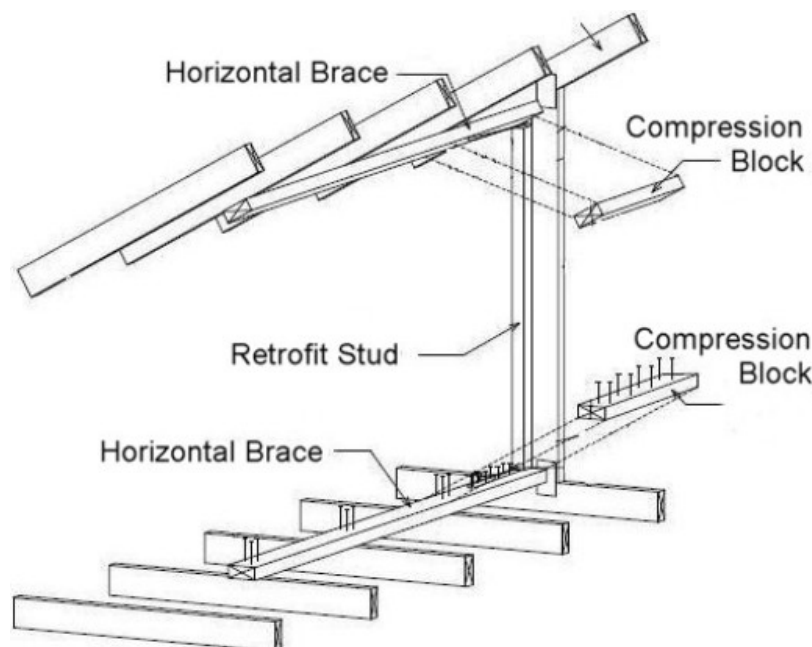
Horizontal braces made of 2x material should be attached to the underneath of the top truss chords (or rafters if roof is stick-built). These braces translate the wind-induced loads placed on the gable ends back into the framing beneath the roof diaphragm and engage the plywood sheathing in helping to secure the gable end.

The following specifications are derived from design guidelines adopted by the Florida Building Commission in October, 2007 for inclusion in the Florida Existing Building Code (FEBEC). The guidelines are part of a separate FEBEC section devoted to retrofitting existing structures to become more resistant to natural

disasters such as hurricanes, floods and wildfires. An entire subsection of these new requirements is devoted to "Retrofitting Gable End Walls." The 3 major components in this gable end retrofit process include the following:

1. Horizontal Braces (including Compression Blocks) at the top of the gable end wall.
2. Horizontal Braces and Compression Blocks at the bottom of the gable end wall.
3. Retrofit Studs to reinforce each existing gable end stud greater than 3 feet in height.

The following perspective drawing shows the location of these 3 major components for a truss-type gable end. The components are the same for a conventionally framed or stick-built gable end.



The remainder of this section will review the actual installation guidelines for Horizontal Braces and Compression Blocks at the top of the gable end. The next section will look at the Horizontal Braces and Compression Blocks at the bottom of the gable end. Attaching the Retrofit Studs to the top and bottom Horizontal Braces and to the existing studs will be covered in the section titled, "Reinforcing Gable End Sheathing and Studs."

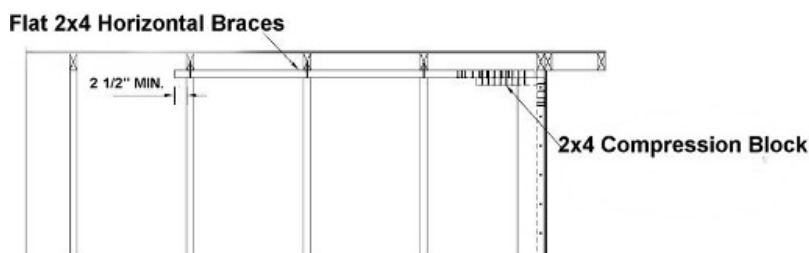
Summary of Design Guidelines for Horizontal Braces at the Top of Gable End Walls

It's important to recognize that the following guidelines are more than just recommendations. Since they have been adopted into the FL Building Code for Existing Buildings they are minimum requirements. Installing materials or following procedures with higher performance criteria (such as longer braces or fasteners or fasteners with thicker shanks) is not a problem. However, failing to meet the minimum standards could result in a failed inspection by a Building Official.

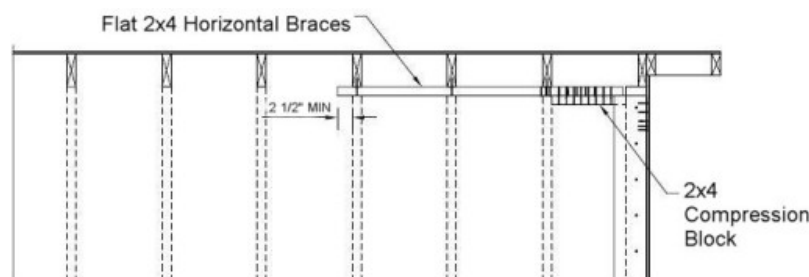
The first guideline covers the material for the horizontal braces and compression blocks. In both cases, conventional 2x4 #2 Spruce-Pine-Fir (SPF) framing lumber is sufficient. In regards to brace spacing, there must be a horizontal brace at each existing gable end stud greater than 3' in height. With respect to brace length, each horizontal brace must

span the first 3 top truss chords or rafters from the gable end PLUS 2 1/2". The extra 2 1/2" extension is to prevent splitting at the end fastened to the last truss chord or rafter. The length of the compression block is one of several components that varies with the maximum height of the gable end and the Basic Wind Speed zone where the house is located.

The drawing below is a section detail that shows a top horizontal brace and compression block attached to a truss roof assembly where the trusses are spaced 24" on center. Note the 2 1/2" extension past the third truss chord (at the left).



The next drawing shows a top horizontal brace and compression block attached to a stick-built roof assembly where the rafters are spaced 16" on center. Note that the horizontal brace is shorter in length but still spans the first 3 rafters in from the gable end (plus the 2 1/2" extension).



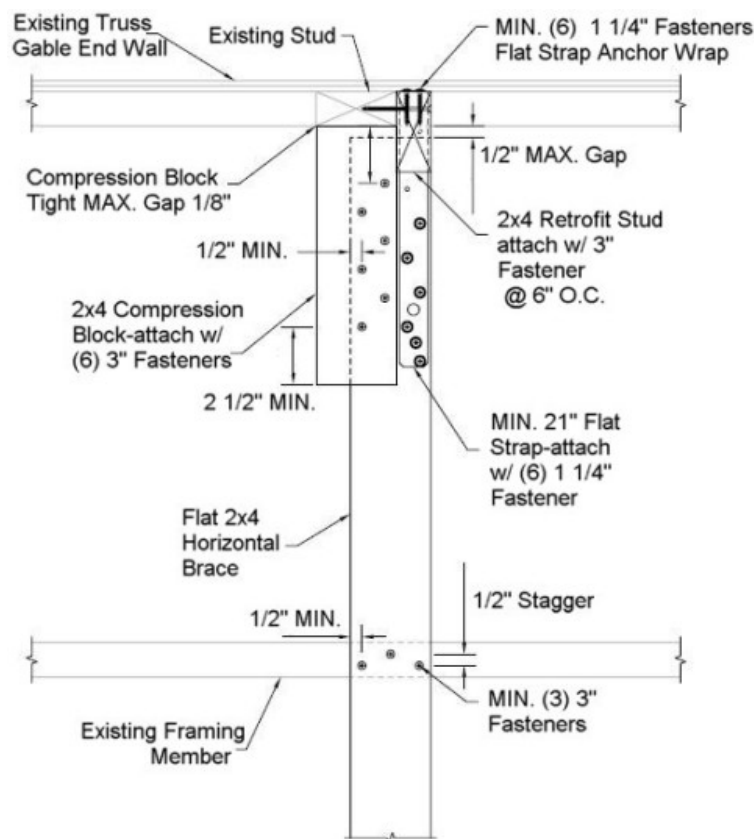
The new Florida Existing Building Code guidelines for Gable End reinforcement contain Table A104.2, "Gable End Retrofit Element Sizing and Fastening." This table lists the various combinations of Maximum Gable End Stud height and Basic Wind Speeds for 2 Exposure Categories (B and C). The complete table shows different values for 9 separate components, the eighth of which is "Minimum Length of Compression Block," and the ninth "Minimum number of fasteners to connect Compression Block to Horizontal Brace." (For more on the difference between Exposure Category B and C see the note at the end of this section).

Table 1504.2
Gable End Retrofit Element Sizing and Fastening

Exposure Category	Maximum 3-Sec Gust Basic Wind Speed	Maximum Height of Gable End Stud			
		8'-0"	11'-3"	14'-9"	16'-0"
C	110	8'-0"	11'-3"	14'-9"	16'-0"
C	120	7'-6"	10'-6"	13'-6"	16'-0"
C	130	7'-0"	10'-0"	12'-3"	16'-0"
C	150	6'-6"	8'-9"	11'-0"	16'-0"
B	110	8'-0"	12'-3"	16'-0"	N/A
B	130	8'-0"	11'-3"	14'-9"	16'-0"
B	140	7'-6"	10'-6"	13'-6"	16'-0"
B	150	7'-0"	10'-0"	12'-3"	16'-0"
8	Minimum length of Compression Block	11 1/4"	13 3/4"	16 1/4"	17 1/2"
9	Minimum number of fasteners to connect Compression Block to Horizontal Brace w/ #8 screws or 10d nails 3" long	6	8	10	12

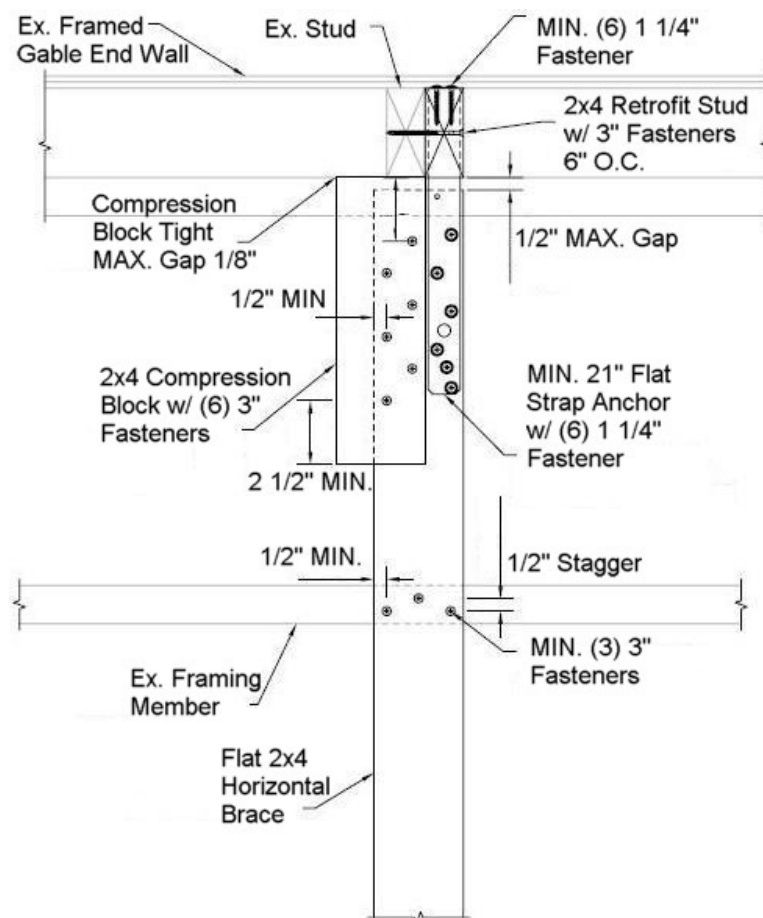
According to this table, the required length of the compression block attached to each horizontal brace varies from a minimum of 11 1/4" to a maximum 17 1/2", and the required number of 3" fasteners varies from 6 to 12. Throughout these guidelines, #8 x 3" screws (deck screws, wood screws or sheet metal screws but NOT fine threaded drywall screws) and 10d common nails (full headed with minimum head dia. 0.30" and shank dia. 0.148") are permitted interchangeably. Wherever screws or nails are used in a retrofit assembly, they must be held back 2 1/2" from the end and 1/2" in from the edge of any framing member.

The next picture is a plan detail of a truss type gable end that shows placement and fastening details for horizontal braces, compression blocks and retrofit studs. Notice the staggered fastener pattern of the 3 screws attaching the horizontal brace to the "existing framing member." Three such 3" fasteners (#8 screws or 10d common nails) are required at each point where a horizontal brace connects to a truss chord or rafter. Note the 1/2" hold back from the edges of the brace. On the compression block, note the 2 1/2" hold back of the fasteners from each end of the block.



The drawing above shows details for a minimum combination of gable end height and wind speed. The 11 1/4" compression block is the smallest required, as is the 2x4 retrofit stud. Notice how the horizontal brace is "offset" 1 1/2" to the right of the existing stud. This is to accommodate the thickness of the retrofit stud and allows the retrofit stud and the stud anchoring strap to align just below and be attached to the horizontal brace above. The compression block is positioned to align with the existing stud. Neither the compression block nor the horizontal brace is fastened directly to the existing stud. This connection is accomplished by the 3" fasteners spaced 6" on center which attach the retrofit stud to the existing stud AND by the flat metal straps which anchor the retrofit stud to the horizontal brace.

The next picture shows this same retrofit assembly (brace, compression block and retrofit stud) for a stick-built gable end. Note the 1 1/2" offset of the horizontal brace and the alignment of the compression block behind the existing stud. All other details are the same as the previous drawing.



Impediments to Installing Top Horizontal Braces

The guidelines for installing the top horizontal braces are pretty straight-forward on paper but certain obstacles may be present in the field. While things like electrical and communication wires, water lines, HVAC ducts and the like are more of an issue for bottom brace installation, truss web members can interfere with both top and bottom brace location. When truss web members interfere with attaching a brace to the top truss chords, an acceptable alternative is to attach the horizontal brace to the web members themselves. The same number and type of fasteners must be installed and the required fastener setbacks from ends and edges must be maintained. The compression block must be aligned behind the existing gable end stud and the brace must be offset so that the strap attaching the retrofit stud to the brace can be installed properly. Steps to overcome additional obstacles at the bottom will be reviewed in the next section.

Note on Wind Exposure Categories in the Florida Building Code

In section 1609.4 of the 2004 Florida Building Code - Building, Exposure category B is defined as "Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger." The codes states further that "Exposure B shall be assumed unless the site meets the definition of another type of exposure." Exposure category C is defined as "Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet extending more than 1500 feet from the building site in any quadrant."

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Section 3: Bracing the Bottom of the Gable End Wall

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Section 3: Bracing the Bottom of the Gable End Wall

Strengthening the connection at the bottom of the gable end wall also involves 2 main steps:

1. Reinforcing the attachment of the gable end wall to the top of the supporting wall below.
2. Attaching a series of horizontal braces to the top of the bottom truss chords (or ceiling joists if stick-built) and fastening the ends of these braces to the gable end retrofit studs.

Reinforcing the Attachment of the Gable End Wall



source: FL Division of Emergency Management

The next picture shows a Simpson Strong-Tie HGAM10 "gusset" connector being used to strengthen the connection between a masonry supporting wall and a gable end truss. (Note that the bottom horizontal brace in the picture is NOT located or attached according to the specifications below).



source: FL Division of Emergency Management

The Simpson HGA10 is a similar "gusset" connector with slightly different dimensions that can be used to strengthen the connection between a gable end truss and a wood frame supporting wall.

These anchors and all metal structural connectors should be installed with the number and type of fasteners required by the manufacturer for full load resistance.

The spacing of this type of right angle gusset bracket depends on the Basic Wind Speed where the home is located. The table below is soon to become part of the FL Building Code for Existing Buildings and gives the required on center spacing for gusset anchors at different design wind speeds in 2 exposure categories.

Exposure Category	Maximum 3-Sec. Gust Wind Speed - V mph	Spacing of Right Angle Gusset Brackets
C	110	38-inches
C	120	32-inches
C	130	28-inches
C	140	24-inches
C	150	20-inches
B	110	48-inches
B	120	40-inches
B	130	36-inches
B	140	30-inches
B	150	26-inches

For conventionally framed (stick-built) gable end walls, each stud greater than 3' in height must be attached to the bottom plate using a metal stud to plate connector. The connection of the bottom plate to the top of the supporting wall must then be reinforced as follows:

- For wood frame supporting walls, 1/4" x 4 1/2" screws must be installed at the same spacing intervals as the gusset brackets in Table 1504.6 above.
- For concrete or masonry supporting walls, 1/4" concrete or masonry screws of sufficient length to penetrate 2 1/2" into the supporting wall must be installed at the same intervals as the gusset brackets in Table 1504.6 above.

Installing Horizontal Braces to the Top of the Bottom Chords or Ceiling Joists

Horizontal braces made of 2x material should be attached to the top of the bottom truss chords (or ceiling joists if the roof is stick-built). These braces translate the wind-induced loads placed on the gable ends back into the framing above the ceiling diaphragm and engage the ceiling joists and drywall in helping to secure the gable end. The next picture illustrates the location and general principal of these horizontal braces, **BUT THE DIMENSIONS OF THE BRACING MATERIAL AND THE MEANS OF ATTACHMENT SHOULD FOLLOW THE SPECIFICATIONS OUTLINED BELOW.**

The following specifications are also derived from the design guidelines adopted in October, 2007 by the Florida Building Commission for inclusion in the Florida Existing Building Code (FEBEC). The remainder of this section will review the actual installation guidelines for Horizontal Braces and Compression Blocks at the bottom of the gable end. The next section, titled "Reinforcing Gable



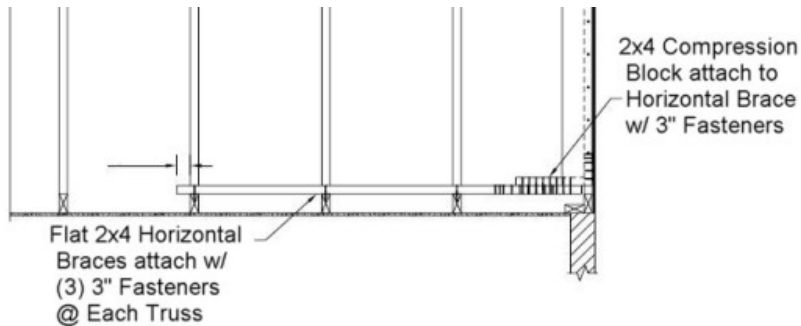
source: Simpson Strong-Tie

End Sheathing and Studs," will look at attaching the Retrofit Studs to the top and bottom Horizontal Braces and to the existing studs.

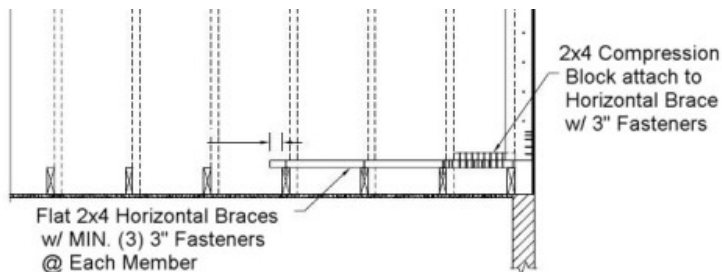
Summary of Design Guidelines for Horizontal Braces at the Bottom of Gable End Walls

As was the case for horizontal braces and compression blocks at the top of the gable end, bottom horizontal braces and compression blocks can also be made from conventional 2x4 #2 Spruce-Pine-Fir (SPF) framing lumber. The spacing requirements are also the same. There must be a bottom horizontal brace at each existing gable end stud greater than 3' in height. Required brace length is also similar. Each bottom horizontal brace must span the first 3 bottom truss chords or ceiling joists from the gable end PLUS 2 1/2" (to prevent splitting at the end fastened to the last truss chord or rafter). And the length of the compression block and number of fasteners required to attach the compression block to the horizontal brace are also based on the maximum height of the gable end and the Basic Wind Speed zone where the house is located. In short, the requirements for the top and bottom horizontal braces and compression blocks are identical.

The drawing below is a section detail that shows a bottom horizontal brace and compression block attached to a truss roof assembly where the trusses are spaced 24" on center. Note the 2 1/2" extension past the third truss chord (at the left).



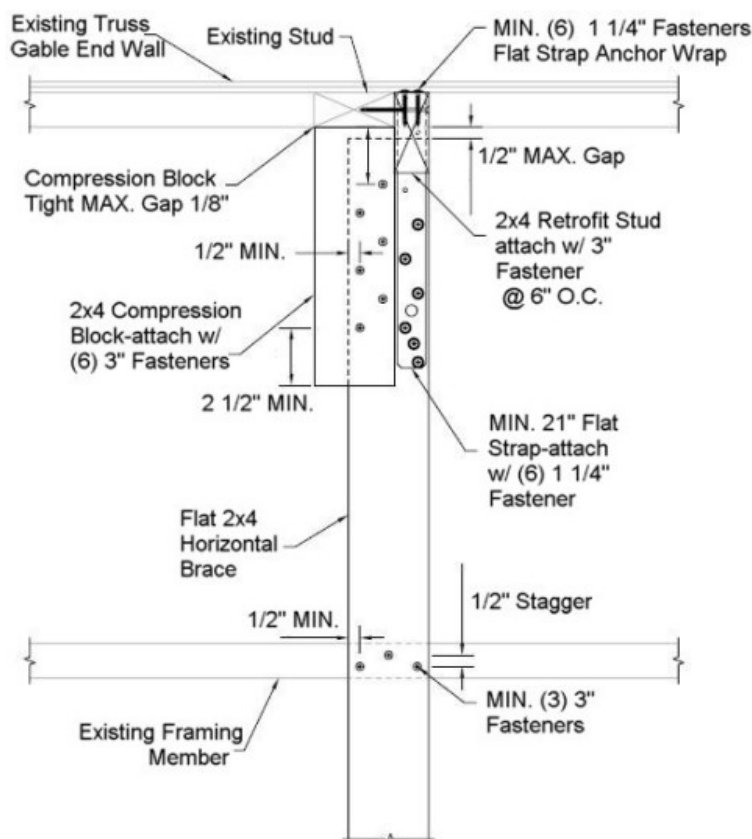
The next picture shows a bottom horizontal brace and compression block attached to a stick-built roof assembly where the ceiling joists are spaced 16" on center. Note that the horizontal brace is shorter in length but still spans the first 3 ceiling joists in from the gable end (plus the 2 1/2" extension).



Once again, wherever 3" fasteners are required, #8 x 3" screws (deck screws, wood screws or sheet metal screws but NOT fine threaded drywall screws) and 10d common

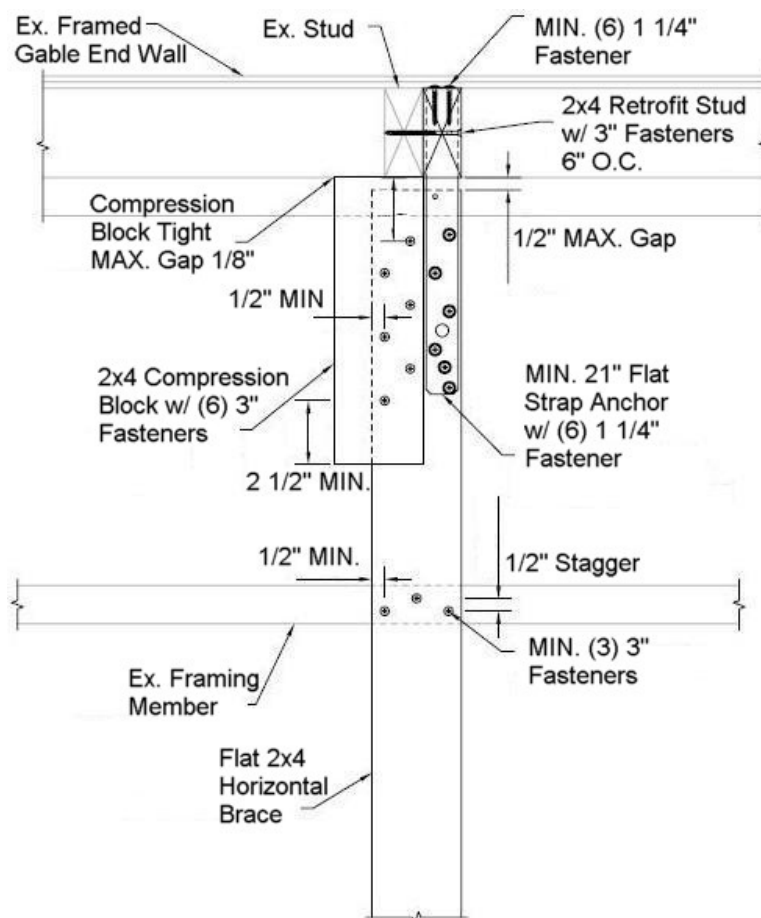
nails (full headed with minimum head dia. 0.30" and shank dia. 0.148") are permitted interchangeably. Finally, the fastener setbacks from the edges and ends of framing members (2 1/2" from the end and 1/2" in from any edge) must be maintained.

The next picture appeared in the previous section on top horizontal braces and is a plan detail of a truss type gable end showing placement and fastening details for horizontal braces, compression blocks and retrofit studs. Notice the staggered fastener pattern of the 3 screws attaching the horizontal brace to the "existing framing member." Three such 3" fasteners (#8 screws or 10d common nails) are required at each point where a horizontal brace connects to a bottom truss chord or ceiling joist. Note the 1/2" hold back from the edges of the brace. On the compression block, note the 2 1/2" hold back of the fasteners from each end of the block.



Notice also that the bottom horizontal brace is "offset" 1 1/2" to the side of the existing stud as was the top brace. This is to accommodate the thickness of the retrofit stud and allows the retrofit stud and the stud anchoring strap to rest on and be attached to the horizontal brace. The compression block is positioned to align with the existing stud. Neither the compression block nor the horizontal brace is fastened directly to the existing stud. This connection is accomplished by the 3" fasteners spaced 6" on center which attach the retrofit stud to the existing stud.

The next picture shows this same retrofit assembly (brace, compression block and retrofit stud) for a stick-built gable end. Note the 1 1/2" offset of the horizontal brace and the alignment of the compression block behind the existing stud. All other details are the same as the previous drawing.

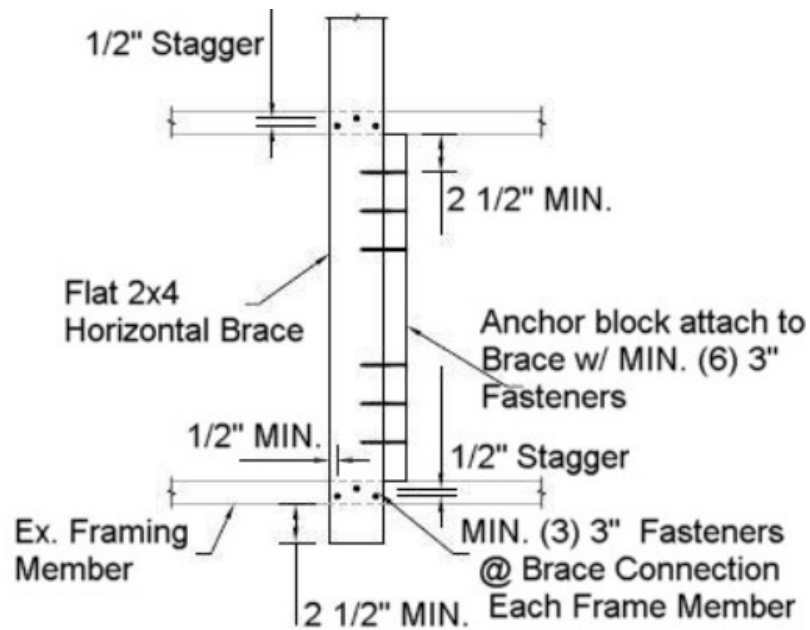


Impediments to Installing Bottom Horizontal Braces

There are many potential obstacles to installing horizontal braces at the bottom of gable end walls. For starters, the tops of the bottom truss chords or ceiling joists are often buried beneath insulation. Electrical, communication and security wires, water lines, HVAC ducts, plumbing vents, recessed light fixtures, and framing for chimney or skylight shafts are just a few examples of things that can complicate installing braces of the required length in the correct locations.

It may be possible to loosen certain items such as wires, ducts, and water lines, and slide the brace beneath, re-securing the items when the retrofit is complete. In other cases, an acceptable alternative is to skew the brace to miss the obstacle. This requires lengthening the brace to span the required number of truss chords or ceiling joists and miter cutting the ends of the brace and compression block to maintain the maximum permitted gaps behind the existing gable end stud (1/2" for horizontal braces and 1/8" for compression blocks). The 2 1/2" extension beyond the last fastener at the end must also be maintained. Finally, the required number of 3" fasteners must be installed at each intersection of the brace and the bottom chords or ceiling joists.

Another alternative is acceptable in situations where the brace can span 2 but not 3 supports in from the gable end. The next drawing shows an "anchor block" attached to the side of such a shortened brace in the space between the first and second supports (whether truss chords or ceiling joists).



The size of this anchor block should be "equivalent to existing framing." For example, if the supporting members are the bottom chords of 2x4 trusses, the anchor block would be a piece of 2x4. If the supports were 2x8 ceiling joists, the anchor block would be a piece of 2x8. Note the type and number of fasteners required to attach the block to the brace and note that the 2 1/2" fastener setback is maintained at the ends. This anchor block detail can also be used for top horizontal braces.

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Section 4: Reinforcing Gable End Sheathing and Studs

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Section 4: Reinforcing Gable End Sheathing and Studs

The last steps in bracing the gable are as follows:

- Reinforcing the gable end wall sheathing
- Installing and anchoring the Retrofit Studs.

Reinforcing Gable End Sheathing

Some wall assemblies are built with types of sheathing that cannot resist hurricane force wind pressures or impacts from wind-borne debris. If the existing gable end wall is sheathed with foam insulation or some type of cellulose fiber panel, the first priority in strengthening the gable end should be to remove the existing siding and replace the sheathing with either plywood or oriented strand board (OSB). Without structural panel sheathing, all the gable end framing reinforcements described above will be worthless.

While both plywood and OSB qualify as structural panels, impact tests have shown plywood to be 30% to 40% more impact resistant than an equivalent thickness of OSB. Another consideration is that plywood is more resistant to deterioration from repeated wetting and drying than OSB.

The new structural panels should be nailed as follows:

- 10d common nails (full size head and shank)
- 6" on center at panel ends and edges
- 6" on center at intermediate supports.

Place a ¼" bead of sub-floor type construction adhesive on each stud before installing the panels. The result will be a wall surface resistant to both impacts and positive and negative wind pressures. Another advantage to removing the existing siding and sheathing is that the bracing measures outlined above can be carried out more easily and efficiently.

In situations where the sheathing is already made of structural panels, the attachment of the sheathing to the gable end studs can be reinforced from the attic access by placing a ¼" bead of construction adhesive on each side of each stud. This is the only retrofit measure to reinforce the sheathing to stud connection that can be carried out without removing the existing siding and re-nailing the sheathing with 10d nails, 6" on center.

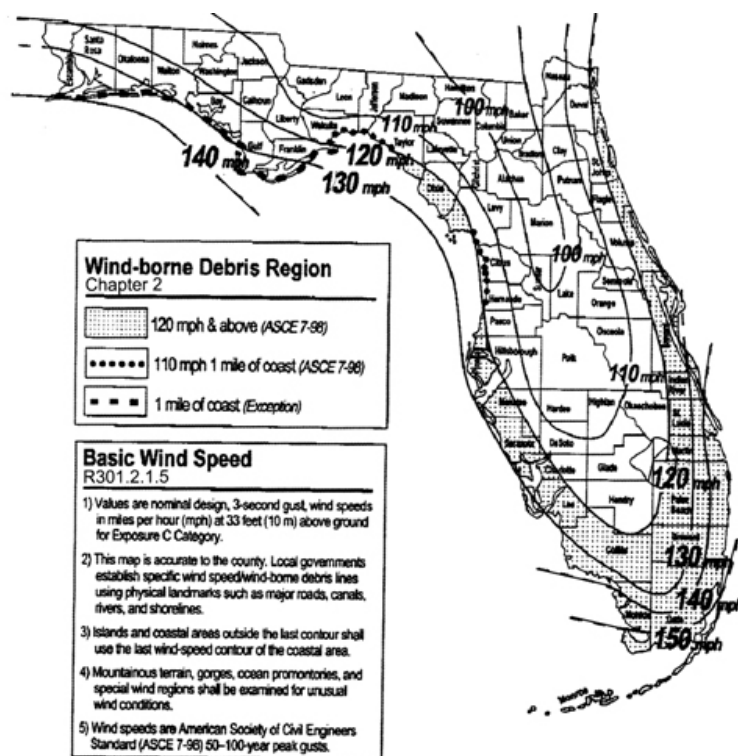
Installing the Retrofit Studs

Gable end walls are either a type of truss with the vertical members installed parallel to the sheathing ("flat framed"), or are stick-built, with individual studs installed perpendicular to the sheathing as in most frame wall assemblies. In either case, the reinforcement strategy is basically the same: attach another piece of framing lumber to the side of each vertical member taller than 3'. The size of the additional framing member (2x4, 2x6, 2x8 or 2 pieces of 2x8) depends on 2 things:

- The Basic Wind Speed zone in which the home is located
- The maximum height of the gable end.

The reinforcement system described below and the accompanying tables are from the design guidelines adopted by the FL Building Commission in October, 2007 for inclusion into the FL Building Code for Existing Buildings.

The first step in the process is to determine the Basic Wind Speed zone for the home. The wind speed map below is from chapter 16 of the 2004 Florida Building Code.



source: Florida Building Code 2004

Next, determine the maximum height of the gable end and the "Exposure Category." The following descriptions of Exposure Categories are taken from section 1609.4 of the 2004 FL Building Code:

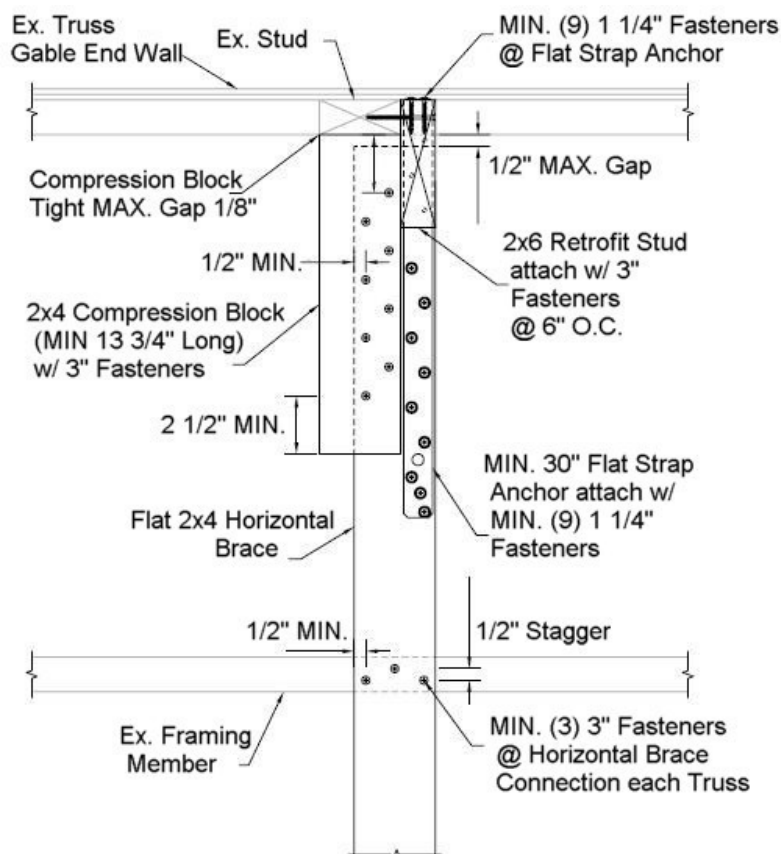
- Exposure B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.
- Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet extending more than 1500 feet from the building site in any quadrant.

Then consult Table A104.2 below. The Exposure Category and Basic Wind Speed combine to locate the correct row and the Maximum Height of Gable End Stud identifies the correct column in the row. For example, if the home is in Exposure Category C, and if the Basic Wind Speed zone from the map above is 130 mph, the correct row is 3rd down from the top. If the maximum gable end stud height is 9' 6" that places us in the second column from the left of the 4 columns below "Maximum Height of Gable End Stud." (Note that any gable height greater than 7' but less than or equal to 10' also falls in this column.)

Table A104.2
Gable End Retrofit Element Sizing and Fastening

Exposure Category	Maximum 3-Sec Gust Basic Wind Speed	Maximum Height of Gable End Stud			
		8'-0"	11'-3"	14'-9"	16'-0"
C	110	8'-0"	11'-3"	14'-9"	16'-0"
C	120	7'-6"	10'-6"	13'-6"	16'-0"
C	130	7'-0"	10'-0"	12'-3"	16'-0"
C	150	6'-6"	8'-9"	11'-0"	16'-0"
B	110	8'-0"	12'-3"	16'-0"	N/A
B	130	8'-0"	11'-3"	14'-9"	16'-0"
B	140	7'-6"	10'-6"	13'-6"	16'-0"
B	150	7'-0"	10'-0"	12'-3"	16'-0"
1	Minimum Horizontal Brace	2x4	2x4	2x4	2 each 2x4
2	Minimum number of fasteners to connect bracing to existing framing - #8 screws or 10d nails 3" long	3	3	3	3
3	Minimum Retrofit Stud	2x4	2x6	2x8	2 each 2x8
4	Minimum Flat Strap Anchor Length	21"	30"	38"	2 straps 30"
5	Minimum number of fasteners to connect Flat Strap to Retrofit Stud - 1 1/4" Fasteners - 1 1/4" long	6	9	12	8 on each strap

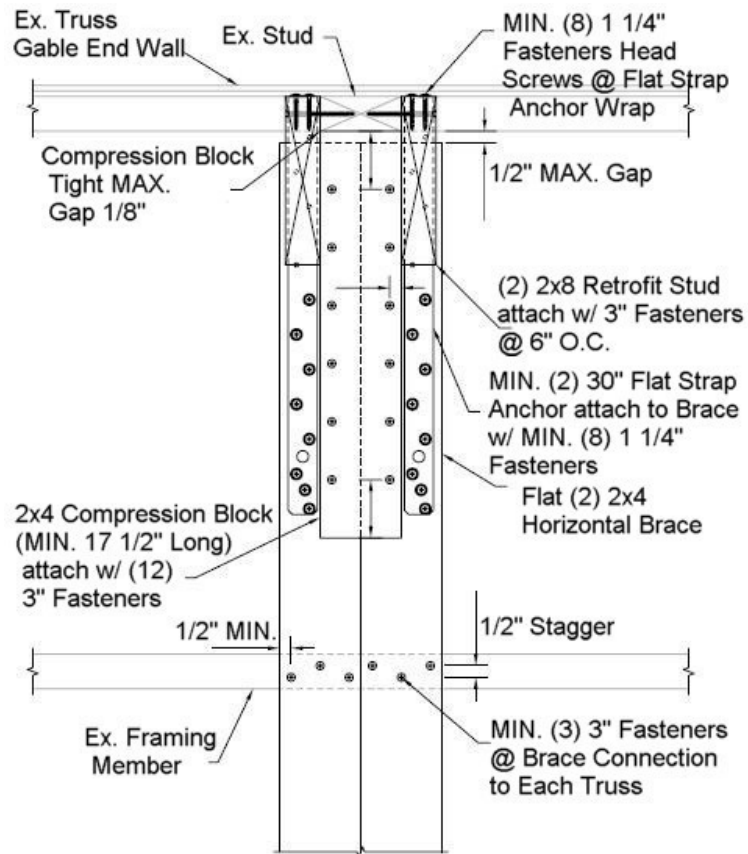
At this point we need to move down this column to the third row in the lower portion of the table. Row 3 tells us the minimum size retrofit stud for our gable end. For the 9' 6" high gable end above, we need to install 2x6 retrofit studs. The drawing below shows the 2x6 retrofit stud installation detail for a truss type gable end.



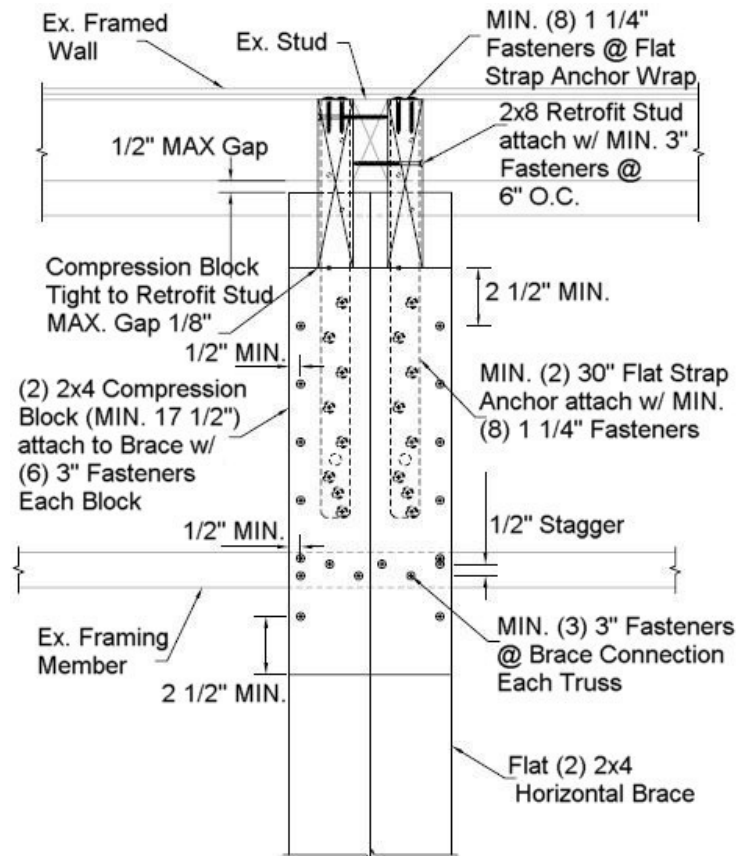
Note that the 2x6 retrofit stud is attached to the existing truss stud with 3" fasteners (#8 screws or 10d common nails) spaced 6" on center. Note also that the "Flat Strap Anchor" attaching the 2x6 retrofit stud to the horizontal brace is 30" long - longer than the 21" anchor strap used for the 2x4 retrofit stud assembly seen in the previous section. Note that more fasteners (9 vs 6) are required to attach the strap to the brace and to the retrofit stud as well. The required flat strap lengths and required number of 1 1/4" fasteners are identified in lines 4 and 5 in Table 1504.2 above.

IT IS IMPORTANT TO UNDERSTAND THAT THE FLAT STRAP ANCHORS TIE THE TOP AND BOTTOM HORIZONTAL BRACES TO THE GABLE END WALL. For this reason, the length, width and thickness specifications for the straps are extremely important. In all cases, the straps must be a minimum 20 gauge metal, 1 1/4" wide with prepunched holes for the fasteners. The length depends on the values from Table A104.2. The straps are bent to a 90 degree angle in such a way that the correct number of 1 1/4" fasteners can be installed in both the edge of the retrofit stud and the face of the horizontal brace. The 1 1/4" fasteners must be located at least 2 1/2" away from the ends of both the retrofit stud and the horizontal brace. The 1 1/4" fasteners are specified in section A104.3.1 of the revised Florida Existing Building Code provisions as #8 screws or 8d nails. When the straps are correctly installed, and the retrofit stud is nailed off to the existing gable end stud, the retrofit assembly is complete and the gable end is successfully braced.

The last column to the right in Table A104.2 above identifies situations in which the maximum gable end stud height is 16'. These situations require that each existing gable end stud taller than 3' be braced with two 2x8 retrofit studs each with their own 30" flat strap anchor. These situations also require two 2x4 top and bottom horizontal braces. The next drawing shows this assembly for a truss type gable end.



Note the alignment of the two 2x4 horizontal braces at the middle of the existing gable end stud and the staggered fastener pattern where the horizontal braces are attached to the supporting truss chords (the "existing framing members" in the drawing). The next and final drawing for this section shows the same assembly for a stick-built gable end.



As in the truss type assembly, there are 2 horizontal braces aligned at the middle of the existing gable end stud and the retrofit studs are installed on opposite sides, but this time with offset rows of 3" fasteners.

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Section 5: Vaulted and Cathedral Ceilings

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